

CLAIMS

I Claim

1.) A process for incorporating an additive into a polymer that comprises the step of melt blending the additive and the polymer at a temperature that is less than the degradation temperature of the additive, where the polymer has a conventional melt temperature range that is above the degradation temperature of the additive.

2.) The process of claim 1 in which the polymer is molecularly disentangled.

3.) The process of claim 1 or 2 in which the additive is selected from the group consisting of a brominated flame retardants, aluminum trihydrate, flour, polyaniline, conductive polymers, light stabilizers, thermal stabilizers, antistatic agents, biocides, coupling agents, peroxides, blowing agents, pigments, polymers, oligomers, nanoclays, and any combination of the preceding.

4.) The process of claims 1 or 2 in which the polymer is selected from the group consisting of ethylene propylene copolymer, high-density polyethylene, high-impact polystyrene, low-density polyethylene, polyamide, polyacrylic acid, polyamide-imide, polyacrylonitrile, polyarylsulfone, polybutylene, polybutadiene acrylonitrile, polybutadiene styrene, polybutadiene terephthalate, polycarbonate, polycaprolactone, polyethylene, polyethyl acrylate, polyetheredierketone, polyethylene sulfone, polyethylene terephthalate, polyethylene terephthalate glycol, polyimide, polyisobutylene, polymethyl acrylate, polymethyl ethyl acrylate, polymethyl methacrylate, polyoxymethylene (polyacetal), polyphenylene ether, polyphenylene oxide, polyphenylene sulfide, polypropylene terephthalate, polystyrene, polytetrafluoroethylene, polyurethane, polyvinyl alcohol, polyvinyl acetate, polyvinyl chloride, polyvinylidene chloride, polyvinylidene fluoride,

polyvinyl methyl ether, polyvinyl methyl ketone, styrene butadiene, styrene butadiene rubber, cellulose acetate, cellulose acetate butyrate, cellulose acetate propionate, cellulose nitrate (celluloid), chlorinated polyethylene, chlorotrifluoroethylene, ethylene acrylic acid, ethylene butyl acrylate, ethyl cellulose, and polymers and copolymers of acrylonitrile butadiene acrylate, acrylonitrile butadiene styrene, acrylonitrile, chlorinated PE and styrene, acrylonitrile methyl methacrylate, acrylonitrile, acrylonitrile styrene, acrylonitrile, butadiene acrylonitrile, ethylene propylene diene monomer, and blends or copolymers of the preceding.

5.) A process for incorporating an additive into a polymer melt comprising the steps of;

- (i) providing a molecularly disentangled polymer melt,
- (ii) providing an additive,
- (iii) transferring the disentangled melt and the additive to a means for blending the additive with said disentangled polymer melt, and
- (iv) blending said disentangled polymer melt with said additive.

6.) The process of claim 5 in which the polymer is selected from the group consisting of ethylene propylene copolymer, high-density polyethylene, high-impact polystyrene, low-density polyethylene, polyamide, polyacrylic acid, polyamide-imide, polyacrylonitrile, polyarylsulfone, polybutylene, polybutadiene acrylonitrile, polybutadiene styrene, polybutadiene terephthalate, polycarbonate, polycaprolactone, polyethylene, polyethyl acrylate, polyetheredierketone, polyethylene sulfone, polyethylene terephthalate, polyethylene terephthalate glycol, polyimide, polyisobutylene, polymethyl acrylate, polymethyl ethyl acrylate, polymethyl methacrylate, polyoxymethylene (polyacetal), polyphenylene ether, polyphenylene oxide, polyphenylene sulfide, polypropylene terephthalate, polystyrene, polytetrafluoroethylene, polyurethane, polyvinyl alcohol, polyvinyl acetate, polyvinyl chloride, polyvinylidene chloride, polyvinylidene fluoride, polyvinyl methyl ether, polyvinyl methyl ketone, styrene butadiene, styrene

butadiene rubber, cellulose acetate, cellulose acetate butyrate, cellulose acetate propionate, cellulose nitrate (celluloid), chlorinated polyethylene, chlorotrifluoroethylene, ethylene acrylic acid, ethylene butyl acrylate, ethyl cellulose, and polymers and copolymers of acrylonitrile butadiene acrylate, acrylonitrile butadiene styrene, acrylonitrile, chlorinated PE and styrene, acrylonitrile methyl methacrylate, acrylonitrile, acrylonitrile styrene, acrylonitrile, butadiene acrylonitrile, ethylene propylene diene monomer, and blends or copolymers of the preceding.

7.) The process of claim 5 in which the additive is selected from the group consisting of brominated flame retardants, aluminum trihydrate, flour, polyaniline, conductive polymers, light stabilizers, thermal stabilizers, antistatic agents, biocides, coupling agents, peroxides, blowing agents, pigments, polymers, oligomers, nanoclays, and any combination of the preceding.

8.) The process of claim 5 in which said means for blending comprises a step selected from the group consisting of continuous extrusion, batch blending, and a means for molecularly disentangling polymer chains.

9.) The process of claim 8 in which the means for molecularly disentangling polymer chains comprises a Tek Flow processor.

10) The process of claim 8 in which said means for molecularly disentangling polymer chains comprises the step of subjecting the polymer to a mechanical vibration at a frequency of up to 100Hz.

11.) The process of claim 9 in which the means for molecularly disentangling the polymer chains further comprises the step of subjecting the polymer to extensional flow.

12.) The process of claim 8 in which the means for molecularly disentangling the polymer chains comprises the step of subjecting the polymer to shear.

13.) The process of claim 11 in which the means for molecularly disentangling the polymer chains further comprises the step of subjecting the polymer to extensional flow.

14.) The process of claim 5 in which said blending step takes place at a temperature that is at least 20° C below the conventional melt temperature range of the polymer.

15.) A product that comprises a blend of a polymeric material and one or more additives, said product being made by a process that comprises the step of melt blending the additive and the polymer at a temperature that is less than the degradation temperature of the additive, where the polymer has a conventional melt temperature range that is above the degradation temperature of the additive.

16.) The product of claim 15 in which the polymer is molecularly disentangled.

17.) The product of claim 15 or 16 in which the additives are selected from the group consisting of brominated flame retardants, aluminum trihydrate, flour, polyaniline, conductive polymers, light stabilizers, thermal stabilizers, antistatic agents, biocides, coupling agents, peroxides, blowing agents, pigments, polymers, oligomers, nanoclays, and any combination of the preceding.

18.) The product of claim 15 or 16 in which the polymer is selected from the group consisting of ethylene propylene copolymer, high-density polyethylene, high-impact polystyrene, low-density polyethylene, polyamide, polyacrylic acid, polyamide-imide, polyacrylonitrile, polyarylsulfone, polybutylene, polybutadiene

acrylonitrile, palybutadiene styrene, palybutadiene terephthalate, polycarbonate, polycaprolactone, polyethylene, polyethyl acrylate, polyetheredierketone, polyethylene sulfone, polyethylene terephthalate, polyethylene terephthalate glycol, polyimide, polyisobutylene, polymethyl acrylate, polymethyl ethyl acrylate, polymethyl methacrylate, polyoxymethylene (polyacetal), polyphenylene ether, polyphenylene oxide, polyphenylene sulfide, polypropylene terephthalate, polystyrene, polytetrafluoroethylene, polyurethane, polyvinyl alcohol, polyvinyl acetate, polyvinyl chloride, polyvinylidene chloride, polyvinylidene fluoride, polyvinyl methyl ether, polyvinyl methyl ketone, styrene butadiene, styrene butadiene rubber, cellulose acetate, cellulose acetate butyrate, cellulose acetate propionate, cellulose nitrate (celluloid), chlorinated polyethylene, chlorotrifluoroethylene, ethylene acrylic acid, ethylene butyl acrylate, ethyl cellulose, and polymers and copolymers of acrylonitrile butadiene acrylate, acrylonitrile butadiene styrene, acrylonitrile, chlorinated PE and styrene, acrylonitrile methyl methacrylate, acrylonitrile, actylonitrile styrene, acrylonitrile, butadiene acrylonitrile, ethylene propylene diene monomer, and blends or copolymers of the preceding.

19.) A product that comprises a blend of a polymeric material and one or more additives, said product being made by the process of

- (i) providing a molecularly disentangled polymer melt,
- (ii) providing an additive,
- (iii) transferring the disentangled melt and the additive to a means for blending the additive with said disentangled polymer melt, and
- (iv) blending said disentangled polymer melt with said additive.

20) The product of claim 19 in which said molecularly disentangled melt has been provided by processing a polymer in a Tek Flow processor.

21) The product of claim 20 in which said molecularly disentangled melt has been provided by processing a polymer in a means for disentangling the

polymer chains that comprises the step of subjecting the polymer to a mechanical vibration at a frequency of up to 100Hz.

22.) The product of claim 21 in which the means for molecularly disentangling the polymer chains further comprises the step of subjecting the polymer to extensional flow.

23.) The product of claim 21 in which the means for molecularly disentangling the polymer chains comprises the step of subjecting the polymer to shear.

24.) The product of claim 23 in which the means for molecularly disentangling the polymer chains further comprises the step of subjecting the polymer to extensional flow.

25.) A process for incorporating an additive into a polymer melt comprising the steps of;

- (i) providing a molecularly disentangled polymer melt,
 - (ii) providing an additive,
 - (iii) transferring the disentangled melt and the additive to a means for blending the additive with said disentangled polymer melt, and
 - (iv) blending said disentangled polymer melt with said additive,
- in which said molecularly disentangled melt is obtained by passing a polymer melt through a means for disentangling a polymer melt, said means for disentangling comprising a Tek Flow processor.